Horizon
Fuel Cell Technologies

H-500 Fuel Cell Stack
User Manual

V2.0

Updated 25 Jan 2010

OVERVIEW OF THE STACK

Thank you for choosing our fuel cell stack. The Horizon fuel cell stack is an air-cooled, light weight and compact fuel cell stack.

Please read all instructions carefully prior to product use and keep this manual for future reference.

Further copies can be obtained from Horizon Fuel Cell Technologies or by emailing: support@horizonfuelcell.com

Please refer to the Horizon website for latest information: www.horizonfuelcell.com

Specifications and descriptions in this document were in effect at the time of publication. Horizon Fuel Cell Technologies reserves the right to change specifications, product appearance or to discontinue products at any time.

IMPORTANT

In order for the warranty to come into effect the stack must be registered on the Horizon Warranty Page at: www.horizonfuelcell.com/warranty.htm

Do not attempt, under any circumstance, to disassemble or inappropriately tamper with the fuel cell. There will be no returns, refunds or exchanges should disassembly or tampering occur. If you have questions or need help with regards to the fuel cell and its technology contact: support@horizonfuelcell.com

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1. Terminology

PEM fuel cell:
a PEM (Proton Exchange Membrane) fuel cell is a device that converts hydrogen and oxygen into water and electricity.

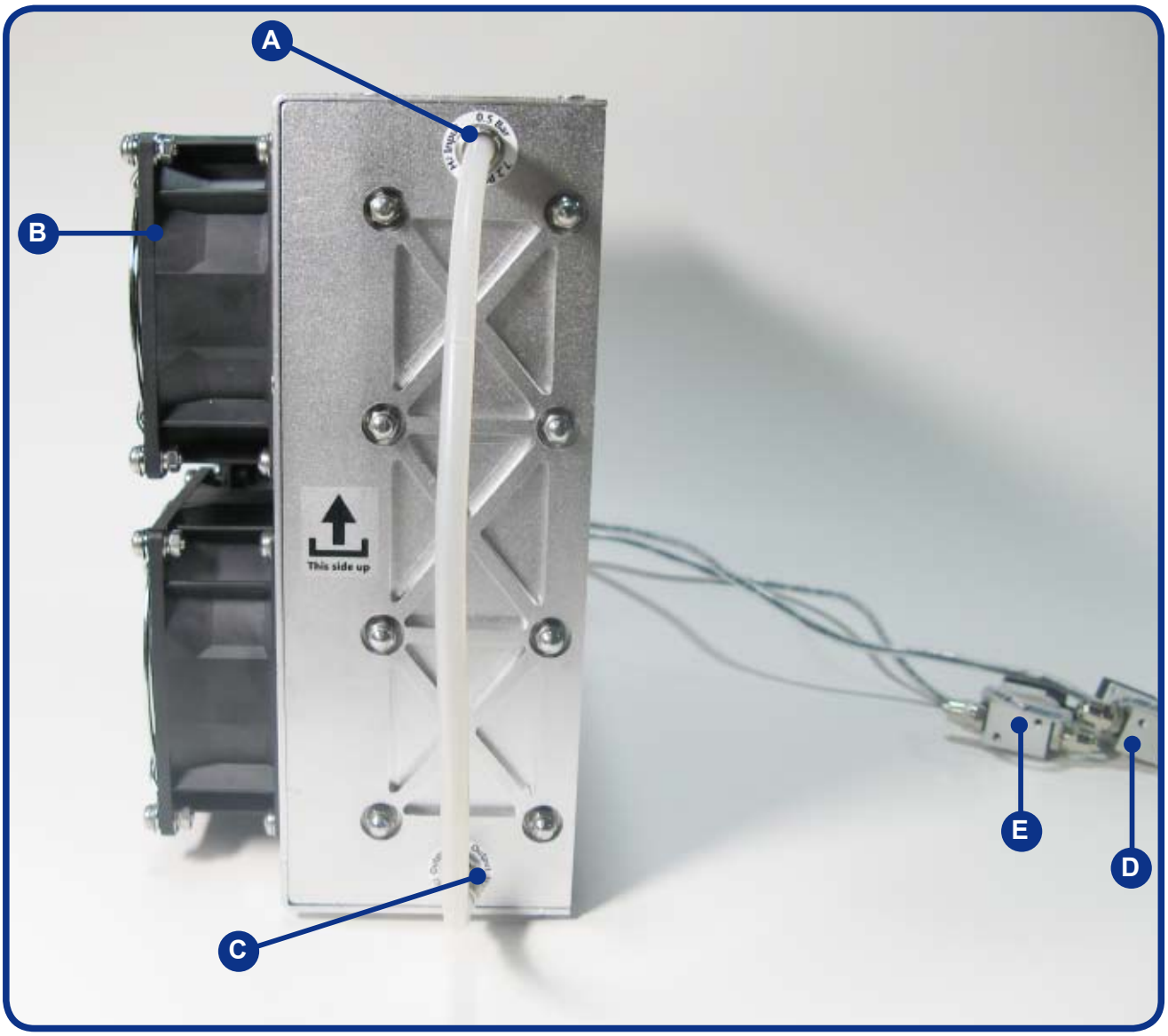
Reactants:
reactant is a material used to start a chemical reaction. In the fuel cell the reactants are air and hydrogen by which the electricity will be generated.

Humidification:
humidity that the fuel cells need for running.

Blower:
supply air to the fuel cells and meanwhile decrease the temperature in the stack.

Mass flow per minute:
the total amount of the hydrogen flow through the fuel cell every minute, which the hydrogen supply can be calculated.

HFCT:
Horizon Fuel Cell Technologies



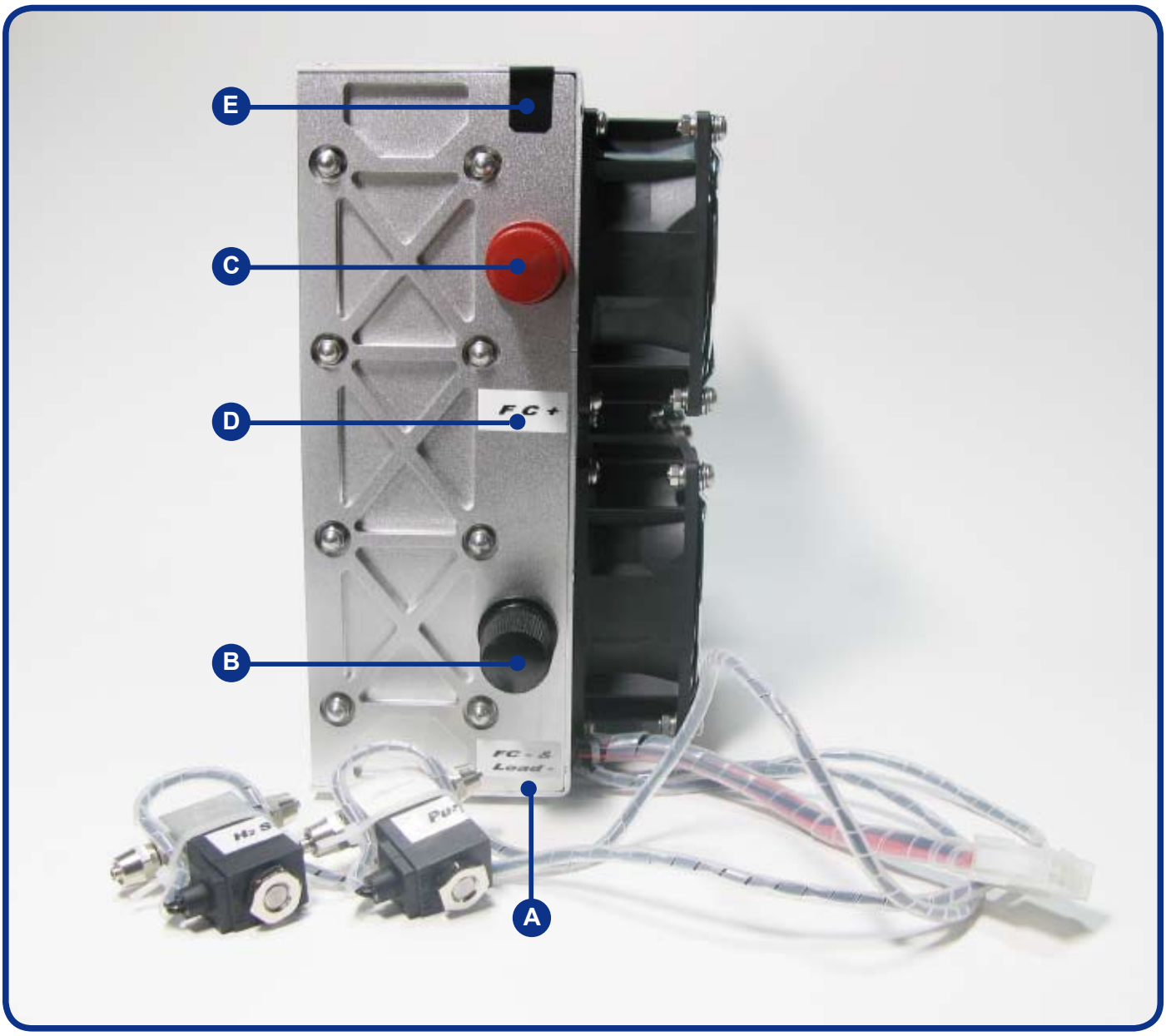
A: Hydrogen Inlet connector

B: Blower

C: Hydrogen Outlet connector

D: Supply valve

E: Purge valve



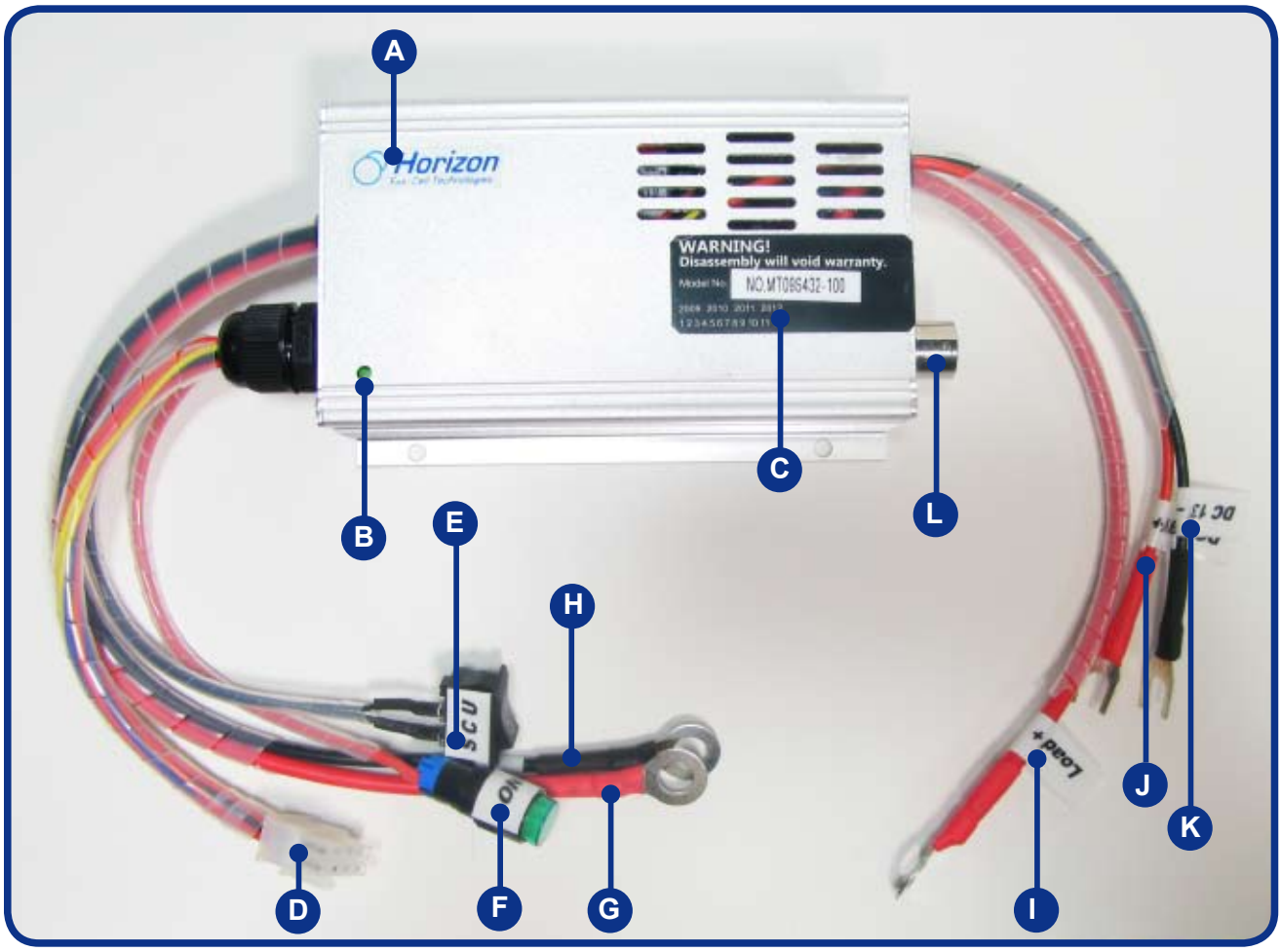
A: Lable (FC- and Load-)

B: FC- and Load- connecter

C: FC+ connecter

D: Lable (FC+)

E: Warning Labels



A: Logo

B: LED

C: Product No.Label

D: Connect plug

E: SCU(short circuit units) switch

F: ON/OFF button

G: Connect to FC+

H: Connect to FC-

I: Connect to Load+

J:Controller power supply DC 13V+

K:Controller power supply DC 13V-

L:LCD connecter

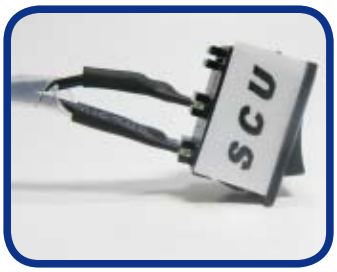
2. Stack and System Component Information

1. Stack

Is made up of plate-like cells with air channels to allow the flow of air across the membrane. The membrane facilitates the flow of Hydrogen creating the release of electrons. Electrically conductive separator plates between each pair of cells enable the flow of electrons. The stack aspect is that they are all placed on top of each other and held together by epoxy endplates.

2. H2 Supply Valve and purge

It controls the H2 input. When the controller turns on, also the H2 supply valve does. When system turns off, it is in the off position for preventing the leakage.



3. Short Circuit Unit

The short circuit unit can be turned on or off depending on what application the stack is to be used in. It ensures enhanced performance of the fuel cells in applications where the stack is turned off for prolonged periods.

4. On/Off Switch

It is the switch of the controller. Hold it for 5 seconds for either on or off.

5. Blower

Supply air to the fuel cells and meanwhile decrease the temperature in the stack.

6. Controller Connector

Connect the stack cables to the lead wires of the T-sensor/ blower/purging valve/input valve on the controller.

7. Controller

Controls the stack temperature, blowers, hydrogen input, purging and short circuiting of the stack.

8. H2 out & H2 In: connect tube in 10 below

H2 OUT: connect tube shown in 10 below.
H2 IN: connect tube shown in 10 below.

9. Fuel Cell +/- Load Connectors

FC+ is connected to the fuel cell positive pole.
FC- is connected to the fuel cell negative pole.

10 . Tube for H2 Input & Output

The tube with 6mm outer diameter and 3mm inner diameter is connected to the H2 Inlet and outlet as in 9 above and to the input valve and output valve of the hydrogen source.

11 . Fittings

For connecting the load.

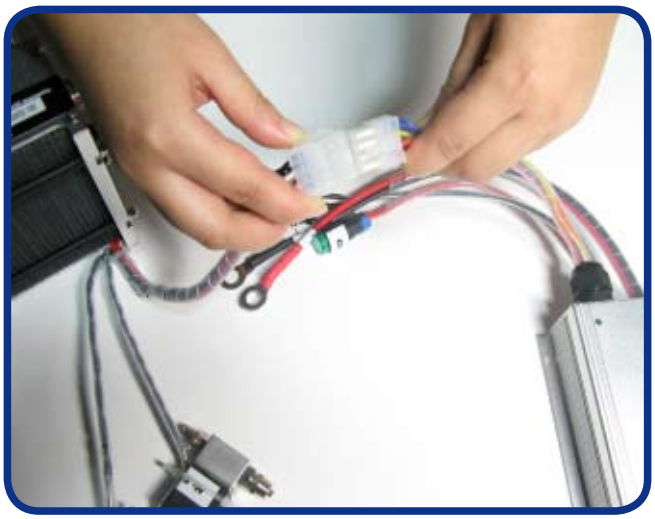
3. Technical Specification

Type of fuel cell	PEM
Number of cells	36
Rated power	500W
Rated performance	22V@23.5A
Output voltage range	18V-34V
Weight (with fan & casing)	4.2kg(9.3lbs)
Size	130 x 220 x 122 mm
Reactants	Hydrogen and Air
Rated H2 consumption	7L/min
Hydrogen pressure	0.5-0.6Bar(7.2-9.4PSI)
Controller weight	0.45kg (0.99lbs)
Hydrogen supply valve voltage	12V
Purging valve voltage	12V
Blower voltage	6-12V
Ambient temperature	5-30°C (41-86°F)
Max stack temperature	65°C (149°F)
Hydrogen purity	99.999% dry H2
Humidification	Self-humidified
Cooling	Air (integrated cooling fan)
Start up time	Immediate
Efficiency of system	40%@22V
	***the flow rate may change with the power output** ****system electronics need external power supply**

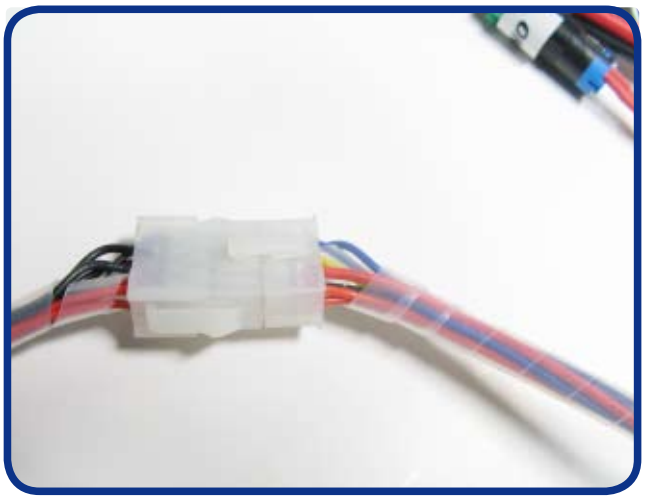
4. System Set-Up

STEP1:

Connect the connectors of the controller and the stack to get the blower, the temperature sensor, the hydrogen supply valve and the purge valve under control. The finished connection is shown in 1B.



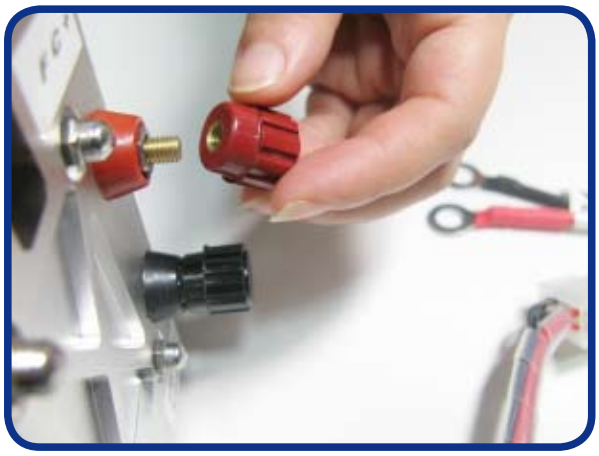
1A



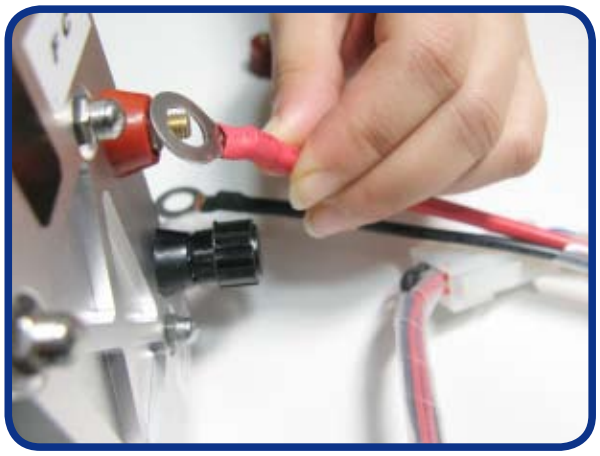
1B

STEP2:

Connect the controller and the stack as the output power also should be under control. The finished connection is shown in 2E.



2A



2B

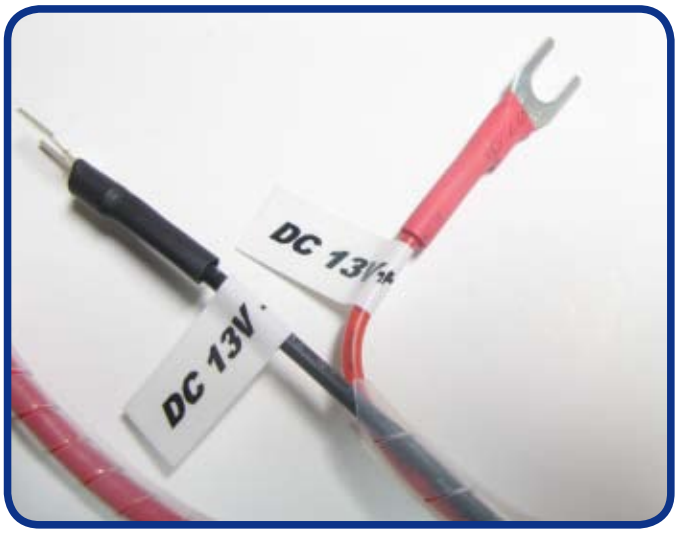
2C

2D

2E

STEP3:

Connect the stack to a stabilized voltage supply through the “13V DC” connectors (3A), and the voltage of the power should be between 12V and 14V.



3A

STEP4:

Keep the SCU (Short Circuit Unit) switch at 1 normally. Only if the short circuit effects the operation, you can use the switch to shut off the short circuit, but it will cause at least 20% performance loss.

4A

STEP5:

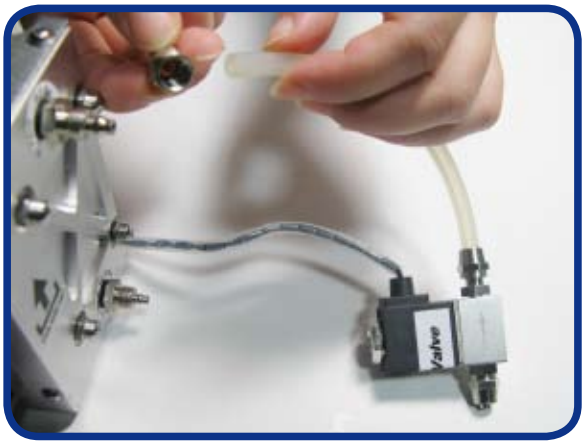
Connect the outside hydrogen supply valve to the stack. The hydrogen supply valve will prevent damage from the hydrogen while the stack is off. Notice the direction of the connection of the Hydrogen supply valve. The finished connection is shown in 5H.

5A

5B

5C

5D



5E

5G

5F

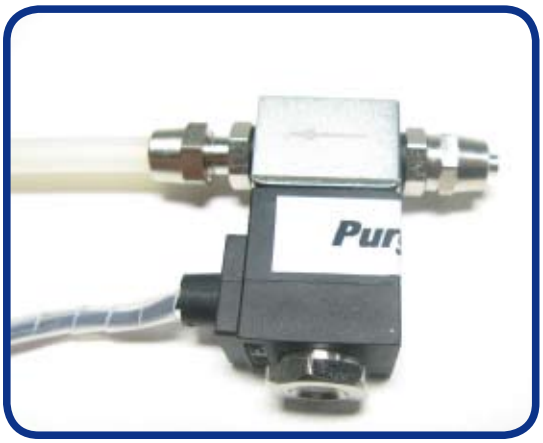
5H

STEP6:

Connect the stack to the purge valve through the filter for a longer running time and a better performance (6A-6E). If not, the gas out of stack may have a negative effect on the purge valve after a long time running. Connect the output of the purge valve to a place away from the stack in case of the damage caused by the hydrogen leakage.

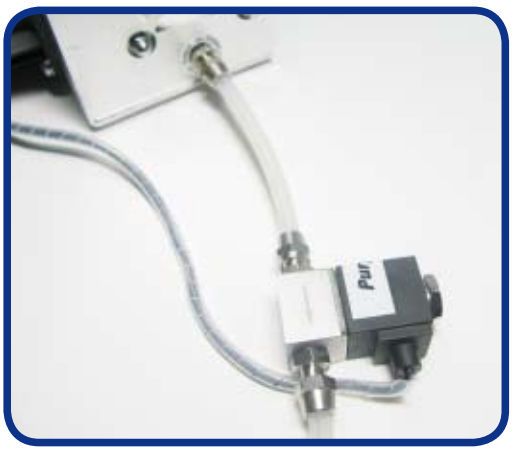
6A

6B



6C

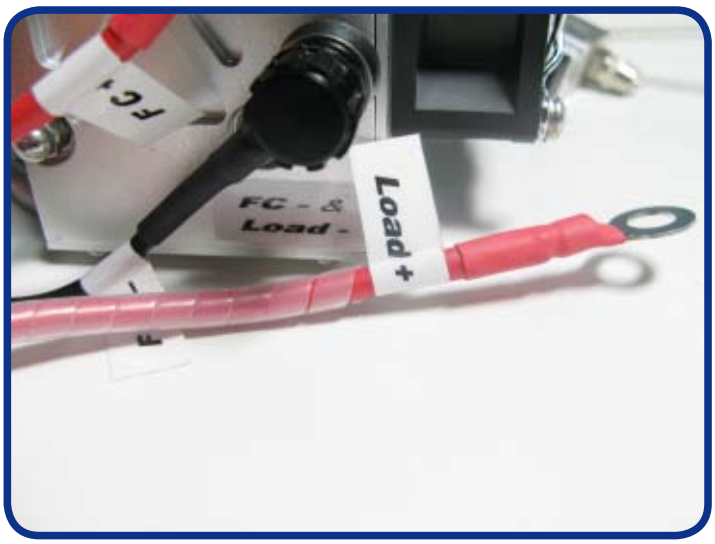
6D



6E

STEP7:

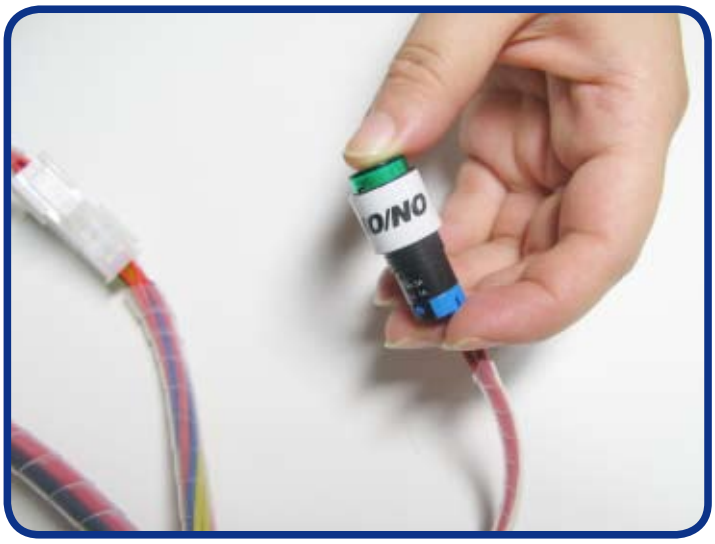
Check all the connection first and connect the load to the system, Load+ is linked to the "load+" at the controller, Load- links to the "FC- and load-" in the stack shown in 7A



7A

STEP8:

Provide hydrogen and stabilized voltage first and then press the ON/OFF switch to start the system.

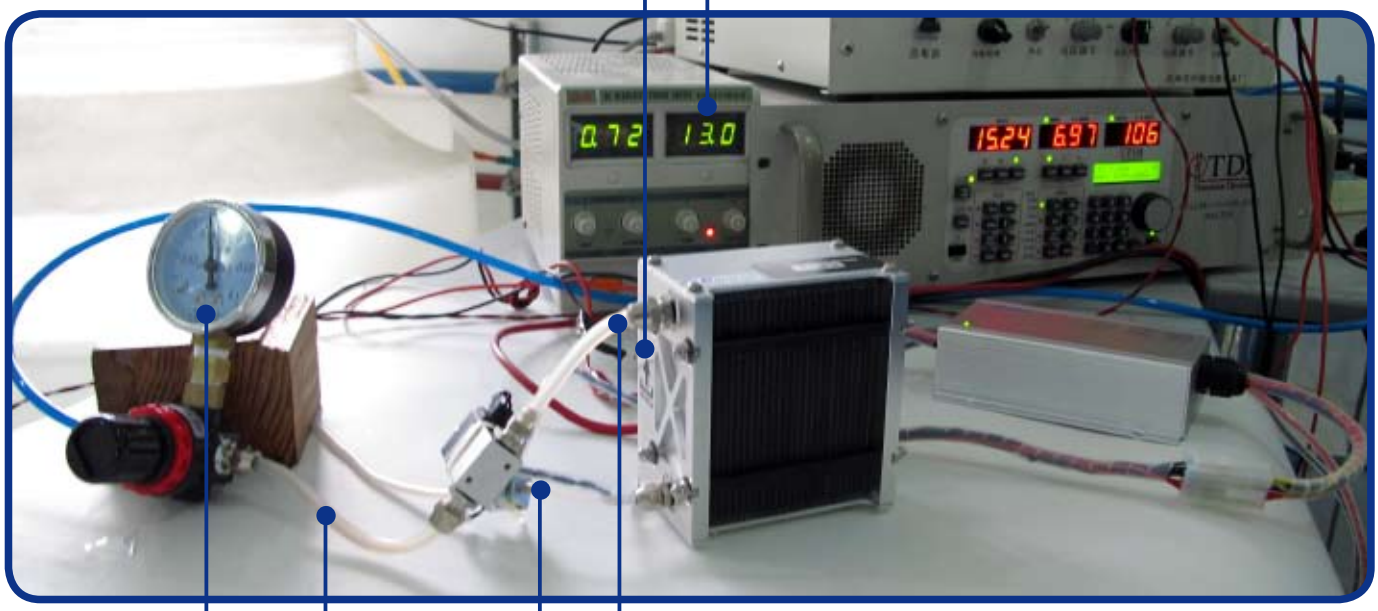


8A

5. Notes for the set-up

Stack should be placed like this position.

The voltage of external power supply is between 12V - 14V, the current range is different based on the different stack.

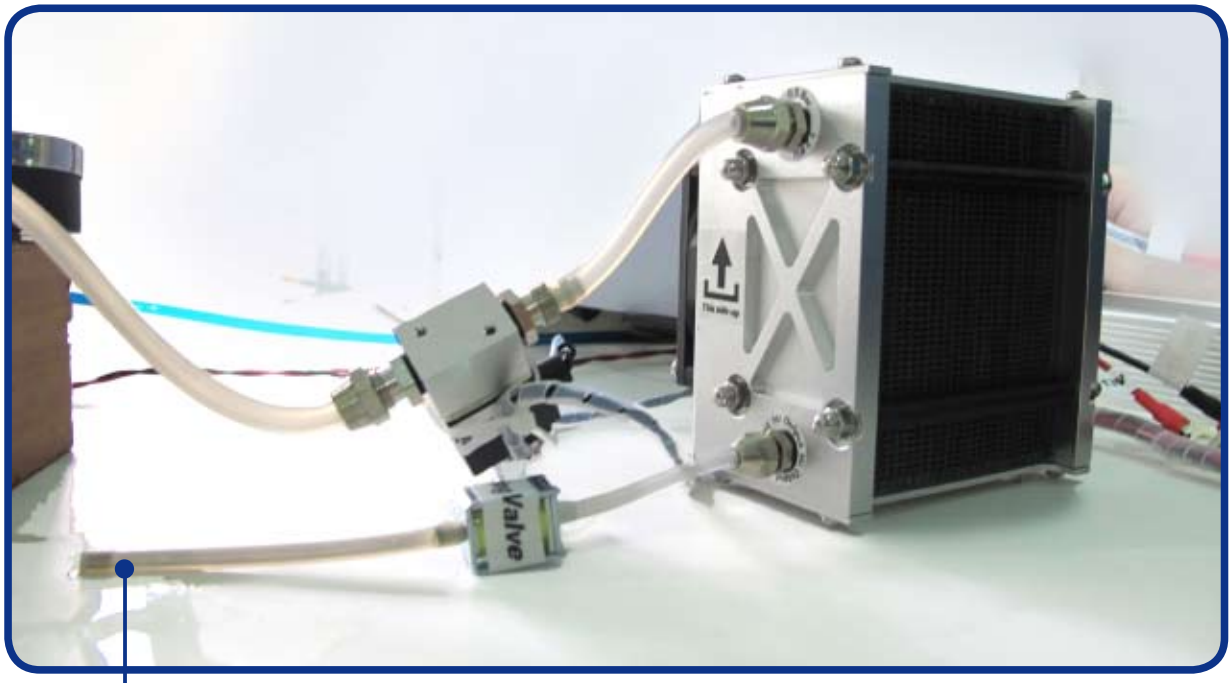


It should be as short as possible between stack and valve.

It should be less than 0.3M between the pressure regulator and the stack.

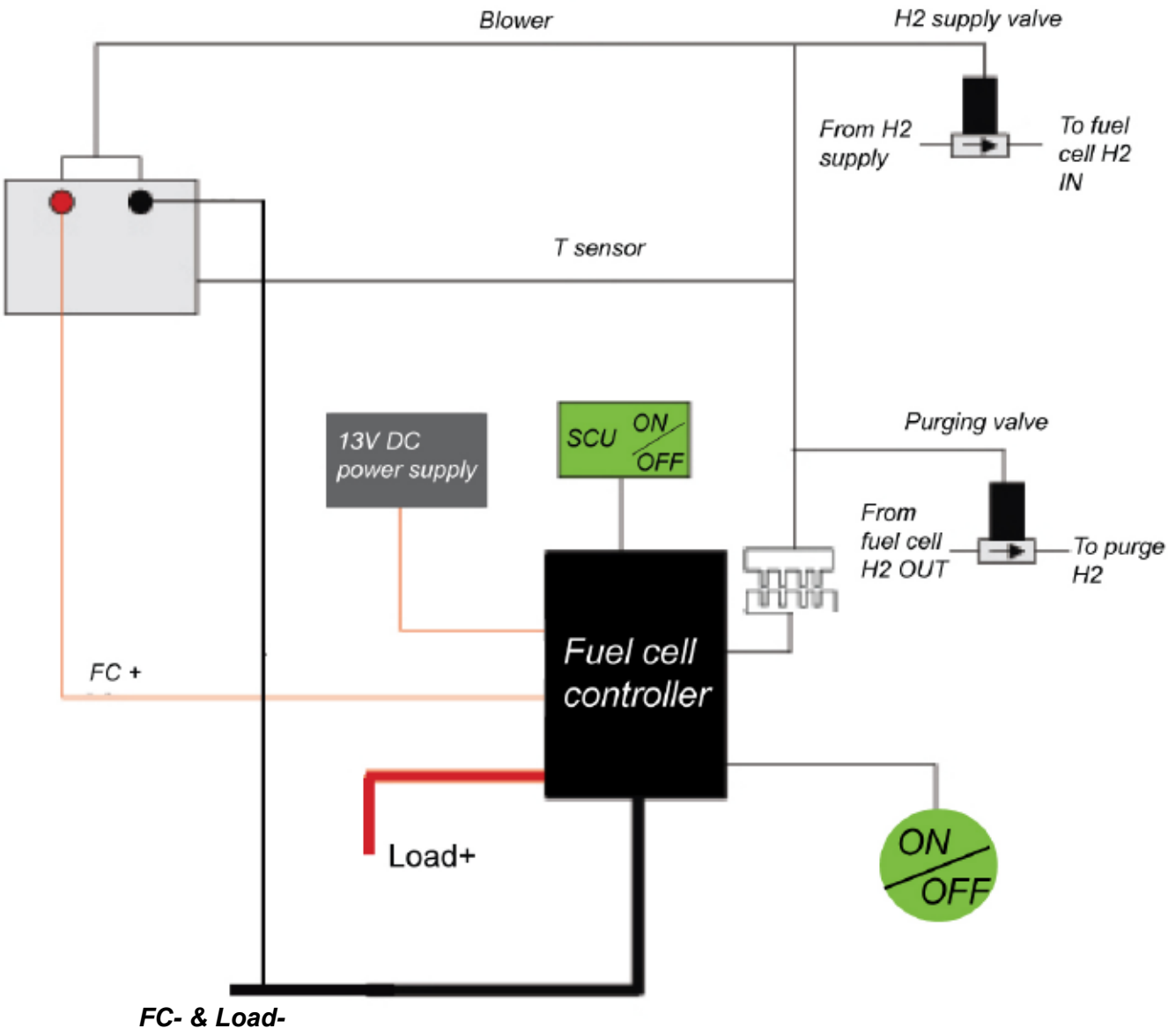
The pressure of the hydrogen is between 0.4--0.45Bar (0.04 -- 0.045Mpa).

The load connecter, load+, is connected to the "load +"in the controller. Connected the load- to "FC- & Load-" in the stack.

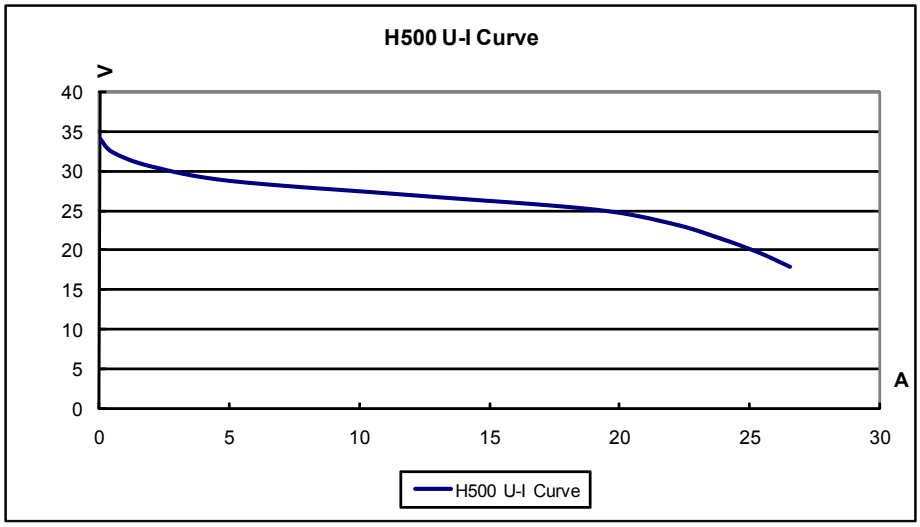


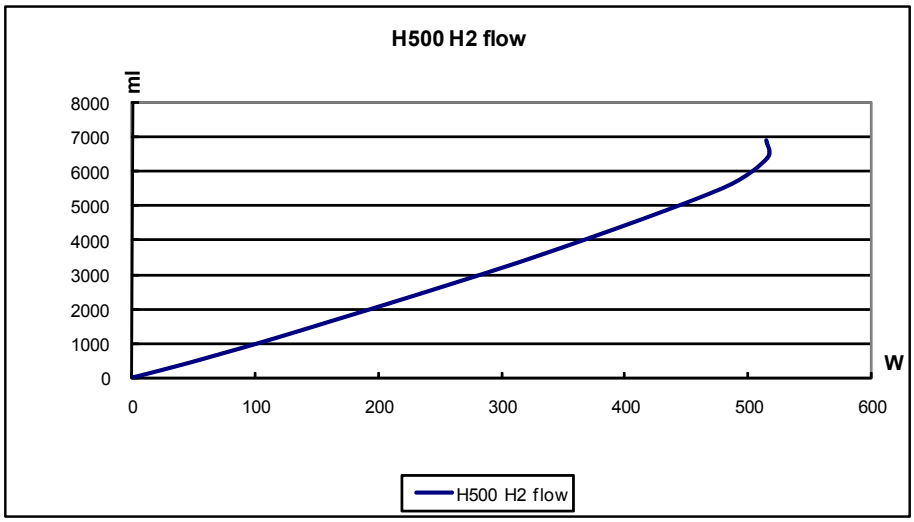
The outlet of the purge valve should be far away from the stack. Don't let the hydrogen from purge valve back to the stack, otherwise it would damage the stack.

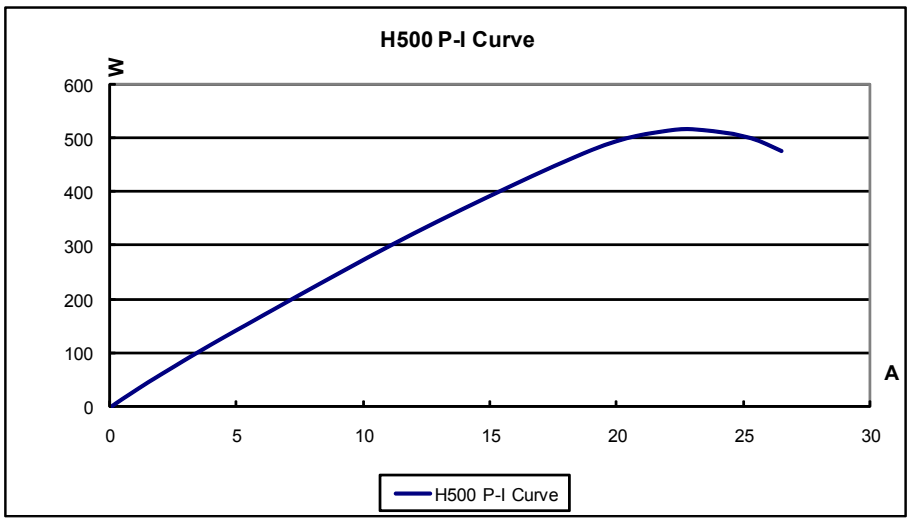
6. System setup diagram



7. Polarization curves







8. Operating instructions

Step 1: Set up the fuel cell system according to the diagram above, make sure that:
- The external DC power supply voltage is between 12V to 15V.
- The pressure is between 0.05 to 0.065Mpa. (7.2-9.4psi)

Step 2: Connect the load to the “FC- & load-” and “Load +”.
Step 3: Start the power supply and Hydrogen supply.
Step 4: Press ON button and the fuel cell system is ready to use.

9. Trouble Shooting & Suggestions

If the stack is not used for a long time (months), it will take a little time to get the manual power, It need 5-30mins

If the system shuts down by itself check the following details:

1. Make sure you have connected all wires according to the diagram.
2. Make sure the external voltage is 12V -15V. The curremt range is over 10A.
3. Make sure you have a hydrogen supply.
4. Make sure the load is below 1000W, because the controller will protect the stack from drawing too much current.
5. Check whether the fuel cell temperature is below 65^{o}C, the system will shut off if it is above 65^{o}C.

Note:

1. Disconnect the hydrogen supply completely if the fuel cell stack is not in operation for more than 4 hours.
2. Use a tube to connect the fuel cell stack hydrogen inlet to the outlet if the fuel cell stack is not in operation.
3. Ensure that the 99.999% of the Hydrogen used is dry. Overuse of humidifiers may cause irreparably damage.
4. Ensure that white nozzle on the purging valve is connected to the fuel cell Hydrogen outlet.
5. The hydrogen outlet must be 20cm away from the fuel cell stack, because the MEA will be damaged permanently if there is hydrogen and oxygen available simultaneously

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